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ABSTRACT

This module on the care and use of the microscope is one of 17 modules designed for individualized instruction in health occupations education programs at both the secondary and postsecondary levels. This consists of an introduction to the module topic, a list of resources needed, and two learning experiences. Each learning experience contains an overview, an objective (e.g., in an actual school situation, demonstrate the proper technique for using a microscope), and three to six activities (e.g., demonstrate the proper care of the microscope by following the steps given on the information sheet; demonstrate how the microscope is used to measure small objects). Information sheets are generally provided for each activity. To provide feedback to students, a self-check with model answers is given for the first learning experience. A student performance assessment form for use by the instructor completes the module. (KC)

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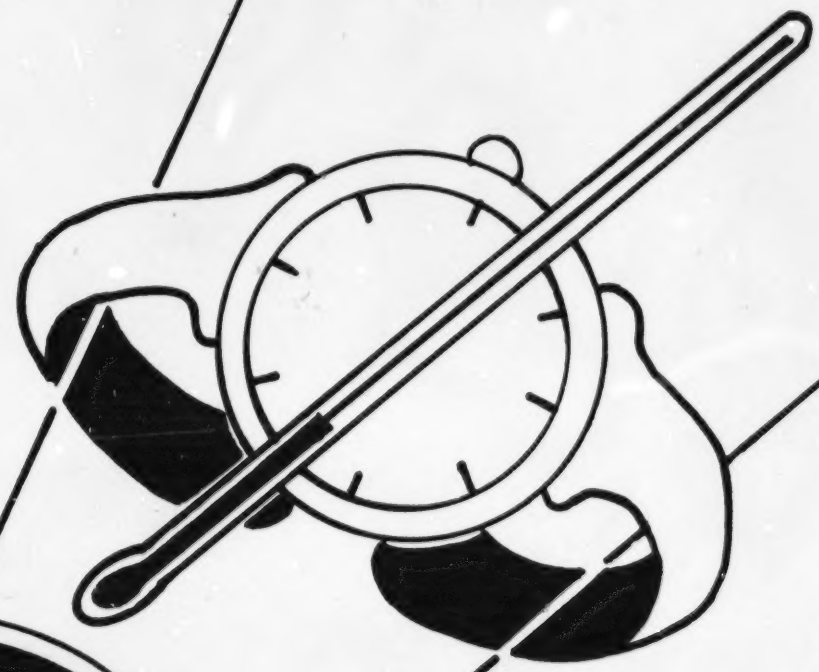
HEALTH OCCUPATIONS EDUCATION MODULE



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THE MICROSCOPE: II - CARE AND USE

2

HEALTH OCCUPATIONS MODULE

designed for the purpose
of individualizing instruction
in the health related occupations
program.

Prepared by...

Temple University of the Commonwealth System of Higher Education

Philadelphia, Pennsylvania

DEPARTMENT OF VOCATIONAL EDUCATION

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BUREAU OF VOCATIONAL EDUCATION

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The suggested prerequisite for this module is the one entitled: "THE MICROSCOPE: I - Structure."

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INTRODUCTION

As a student in Medical Assistant or Laboratory Assistant programs, you will be required to use the microscope. This is one of the most important tools for studying very small objects.

The microscope should be used by the student very early in the course of study. You may already have used a microscope or at least have had the opportunity of looking through one at school. If so, you have some idea of how much more may be seen with the aid of the microscope than with the eye alone. Learning the proper care and use of the microscope are the main purposes of this module.

OBJECTIVES

Terminal Objective: In an actual school situation, demonstrate the proper technique for using a microscope. Your performance will be assessed by your resource person, using the "Student Performance Assessment Form," which is a part of this module (Learning Experience II).

Enabling Objective: Based upon the fact that the microscope is a precision instrument made from very fragile materials, demonstrate the proper care and respect for the microscope (Learning Experience I).

RESOURCES

Listed below are outside resources which supplement those contained within the module. Check with your resource person to determine the availability and location of the resources.

Recommended Films:

1. The Microscope. (McGraw-Hill Text Films; 11 minutes; color.)

This film describes the microscope as a compound series of magnifying lenses. It introduces students to the different parts of the microscope and to their proper care. It uses examples to demonstrate various levels of magnification.

2. The Microscope. (Ealing Film-loops; #82-0159 filmstrip.)

This filmstrip explains the preparation of slides, light systems, lens systems and focusing.

LEARNING EXPERIENCE I

OVERVIEW

Enabling Objective

Based upon the fact that the microscope is a precision instrument made from very fragile materials, demonstrate the proper care and respect for the microscope.

Activity 1

Read the "Information Sheet on the Care of the Microscope."

Activity 2

View the film, The Microscope, a McGraw-Hill Text Film.

Activity 3

Demonstrate the proper care of the microscope by following the steps given on the information sheet read in Activity 1.

Feedback

Your resource person will evaluate your competency in demonstrating the proper care and respect for the microscope by filling out the "Performance Check-list," which is part of this module.

(Activity 1)

INFORMATION SHEET ON THE CARE OF THE MICROSCOPE

Your microscope is an expensive instrument that must be given proper care. Always follow these general directions when using the microscope:

1. Always carry the microscope in the upright position; otherwise, the eyepiece may fall out and break.

2. Always carry the microscope with both hands, one hand under the base, the other hand on the arm.

3. Place the base upon a flat, firm support where it will not tip or be knocked over, preferably in the center of your desk or laboratory table.

4. When working with a microscope, it is best to clear your laboratory table of everything that is not needed.

5. Avoid tilting the microscope when using temporary slides made with water.

6. The lenses of the microscope cost almost as much as all the other parts put together. Therefore, <u>never</u> clean them with anything other than lens paper.

7. When getting ready to put the microscope away, always return it to the low-power setting.

(Activity 2)

View the film, The Microscope (McGraw-Hill Text Films; 11 minutes; color). This film describes the microscope as a compound series of magnifying lenses. It introduces students to the different parts of the microscope and to their proper care. It uses examples to demonstrate various levels of magnification.

While observing the film, pay close attention to:

1. How to carry the microscope.
2. How to clean its lenses.
3. How to adjust the light.
4. How to focus the microscope.

(Activity 3)

Demonstrate to your resource person your skills and knowledge of the proper care of the microscope. Follow the steps given on the "Information Sheet" and the techniques observed in the film.

PROCEDURE

1. Practice the procedures until you have mastered them.
2. Raise your hand to notify your resource person that you are ready to demonstrate your skills.
3. Have the resource person check each step on the "Performance Check-list."

PERFORMANCE CHECK-LIST

Care of the Microscope

	LEVEL OF PERFORMANCE*		
	S	U	NA
1. Laboratory table is clear of everything that is not needed			
2. Carried the microscope with both hands, one hand under the base, the other hand on the arm			
3. Carried the microscope in an upright position			
4. Placed the base of the microscope firmly and flatly in the center of the table			
5. Cleaned the lenses of the microscope using only lens paper			
6. Wiped lens in one direction (not in a circular manner) .			
7. Always started and ended with the objective in the low-power setting			

(* S=Satisfactory; U=Unsatisfactory; NA=Not Applicable)

INSTRUCTOR'S SIGNATURE: _____

COMMENTS: _____

_____

_____

_____

_____

LEARNING EXPERIENCE II

FINAL EXPERIENCE

OVERVIEW

Terminal Objective

In an actual school situation demonstrate the proper techniques for using the microscope.

Activity 1

Read the "Introduction to Learning Experience II."

Activity 2

Based upon the information given, demonstrate your ability to care for slides and cover slips.

Activity 3

View the filmstrip, The Microscope (Ealing Film-loops; #82-0159 filmstrip). This filmstrip explains the preparation of slides, light systems, lens systems and focusing. It demonstrates the technique for making wet mount slides.

Activity 4

Based upon the information given in this activity, demonstrate your ability to use the microscope properly.

Activity 5

Demonstrate your ability to measure the field of view of the microscope under low and high power.

Activity 6

Demonstrate how the microscope is used to measure small objects.

Feedback

Your total competency will be assessed by your resource person, using the "Student Performance Assessment Form."

(Activity 1)

INTRODUCTION TO LEARNING EXPERIENCE II

The microscope is an instrument designed to examine objects too small to be seen with the naked eye. Unaided, the human eye cannot distinguish objects much smaller than 0.1 mm. in diameter. The microscope acts as an extension of the eye, allowing it to see objects beyond its range. Most objects viewed through a microscope are or have been made transparent, in order that light from the mirror will shine through them. Lighting and adjusting the mirror light source is difficult, but is as important to learn as is the focusing of the microscope.

While the lens of your eye automatically adjusts to focus on an object being viewed, the lenses of the microscope are focused mechanically. A pair of wheels--the coarse and fine adjustment--move the focus toward or away from the object being viewed.

An important factor in using the microscope is the distance between the object being viewed and the objective lens of the microscope. For proper focusing, the lens must be much close. to the object under high magnification than under low magnification. Remember that there is a greater risk of crushing a slide when using high-power than when using low-power.

In using a microscope, it is important to know how much you are magnifying an object. To find the magnification, multiply the number on the eyepiece by the number on the objective. If the eyepiece power is 10X and the objective power is 45X, the total magnification is 10X multiplied by 45X, or 450X.

The most common oojectives found on the microscope are:

Scanning Objective - 4X
Low-power Objective - 10X
High-power Objective - 45X
Oil Immersion Objective - 100X

(Activity 2)

CARE OF SLIDES AND COVER SLIPS

Slides and cover slips need careful hardling. If they are picked up by the edges, fingerprint problems will be avoided. Plastic coverslips don't break as easily as glass ones, but they get scratched very readily. Before the microscopes are put away, make sure the slides are removed.

Slides should be cleaned after use by dipping them into detergent solution, rinsing with clear water, draining on paper towels, and then polishing them until they are free of any smear. Cover slips should be cleaned in the same way.

It is important never to leave a slide in a microscope when the microscope is not in use.

(Activity 3)

View the filmstrip, The Microscope (Ealing Film-loops; #82-0159 filmstrip). This filmstrip explains the preparation of slides, light systems, lens system focusing, and it demonstrates the technique for making wet mount slides.

(Activity 4)

USE OF THE MICROSCOPE

1. Place the microscope on the table or countertop with the arm toward you and the base at a safe distance from the edge. Adjust your position so that you can look into the eyepiece easily.

2. Clean the eyepiece, the objectives and the mirror with lens paper provided for this purpose. (Use only lens paper!) The lens should be wiped in one direction only--not in a circular manner.

3. Cut out the letter "H" (newspaper print) provided by your resource person. Place this on a clean slide, and with a dropper, place one drop of water on the letter.

4. Wait a moment before covering with the cover slip. Hold the cover slip at about a 45° angle to the slide, and slowly lower it. A gentle tapping will usually remove any air bubbles that may be present.

5. Turn the clips outward, place the slide onto the stage of the microscope, clip the slide into place, and move it with your thumb and forefingers until the letter "H" is in the center of the opening on the stage.

6. Make certain that the low-power objective is in place. If it is not, rotate the nosepiece until the low-power clicks into place (in line with the tube of the microscope). Be sure that the tube is high enough so that the lenses do not hit the slide when rotated.

7. While looking through the eyepiece, turn the mirror toward the light source, but never directly toward the sun. Adjust the mirror until a uniform circle of light, without any shadow, appears. This circle of light is the field of view of the microscope. Your microscope probably contains a device to further regulate the amount of light; the iris idaphragm is used to adjust the amount of light. It is located under the stage.

8. When you look through the eyepiece, always keep both eyes open.

9. Look at the stage from the side (focus down); use the coarse adjustment wheel until either the stop is reached--this will prevent further lowering--or until the objective is approximately 1/8 of an inch from the cover slip.

10. Look through the eyepiece and, with the coarse adjustment, raise the tube slowly (focus up) until the letter "H" appears. Move the coarse adjustment knob slowly back and forth until the clearest image of the letter is seen. After you have used the coarse adjustment

to bring the object into focus, carefully turn the fine adjustment knob to improve the focus.

Important: When examining a specimen with the low-power objective, always focus first with the coarse adjustment, and then sharpen the focus with the fine adjustment.

Compare the position of the letter as it is mounted with its appearance in the eyepiece. Record the results.

Observation: _____

11. Looking through the eyepiece, how has the letter changed from its appearance to the naked eye?

Observation: _____

Leave the slide where it is. Now, carefully, switch to the high-power lens. The letter should be in focus.

Most microscopes are "parfocal;" that is, switching objectives will not affect the focus.

If the letter is not in focus, carefully turn the fine adjustment knob until the letter is in sharp focus.

Important: Never use the coarse adjustment with the high-power or oil immersion objectives. If these instructions are followed, it will prevent the high-power or the oil immersion objectives from striking the slides or possibly cracking or chipping the lens of either objective.

12. A specimen that is being examined with the microscope is always focused under the low-power objectives, using first the coarse adjustment, and then the fine adjustment. If greater magnification is desired, the lens is switched to high-power, and then to fine adjustment to bring the object into focus. If looking at an object under the high-power lens, use only the fine adjustment when focusing. Never focus with the high-power objective to find the specimen.

13. When time permits, repeat the above procedure with other letters and words from newsprint, in order to improve your skills in preparing wet mount slides and in focusing.

14. Example: Cut out one letter "A" (newspaper print). Make a wet mount and examine it under low-power. What appears to have happened to the letter?

Observation: _____

15. Make a wet mount of the letter "F" and examine it under low-power. What appears to have happened to the letter?

Observation: _____

16. Make a wet mount of two differently colored hairs crossed over each other. Observe these under low-power, then under high-power, adjusting the fine adjustment as you observe. It is important to remember that by using the adjustments, you bring the microscope into focus at many different levels. At each setting, you see clearly only one plane of the object. To see other planes clearly, you must change the focus. It is impossible to see all parts of a thick object clearly at one focus.

Observation: _____

_____

_____

17. When the microscopic examination is complete, always switch back to low-power, raise the body tube away from the stage (focus up), and remove the slide. This will also prevent damaging the objective. The microscope should be cleaned of any debris from the specimen (use lens paper), and then covered with a special cover to prevent dust from accumulating on it when not in use.

(Activity 5)

MEASUREMENT OF THE MICROSCOPE'S FIELD OF VIEW

Purpose: to learn how to measure the field diameter of the microscope. You will often want to know the size of objects you are observing under the microscope. Because these objects are usually too small to permit direct measurement, it will be convenient for you to learn a method of indirect measurement.

Estimating the diameters of the low and high-power fields will enable you to determine indirectly the approximate size of objects viewed under the microscope.

Materials:

Compound microscope.
Light source.
Flat, transparent metric ruler.

Procedure:

A. Place a flat, transparent metric ruler on the stage of the microscope. Move the coarse adjustment knob until the lines on the ruler are in sharp focus under low-power. Move the ruler so that one of the lines is just visible at the edge of the field.

B. Now, count the greatest number of lines that can be seen within the field of view from one side to the other. The space between each line is one millimeter, abbreviated "mm."

You can measure the field of view for both a hand lens and a microscope by counting the millimeter marks seen in each.

1. What is the diameter in millimeters of the low-power magnification field of your microscope? (Answers will vary, depending on the kind of microscope.)

Observation: _____

C. With the ruler, measure the diameter of the field at high-power magnification.

1. What is the diameter of the field at high-power? (Answer will vary depending on the kind of microscope.)

Observation: _____

2. Did the size of the field get larger or smaller as the magnification increased from low to high-power?

Observation: _____

D. There are 1,000 microns in one millimeter. To change millimeters to microns, multiply the number of millimeters by 1,000.

1. What is the diameter of the field in microns at low-power magnification? At high-power magnification? (To find the diameters in microns, look at your answers to questions C.1. and C.2., and multiply these values by 1,000.)

Answers: Low-power: _____

High-power: _____

E. The total magnification of the microscope and the size of the field are said to be inversely proportional. As the magnification increases, the size of the field decreases by the same factor.

Example: If a field of view measured 20 mm. at 50X magnification, it would measure 5 mm. at 200X magnification. As the magnification increased by a factor of four, the field size decreased by a factor of four and became one-fourth (¼) the original size.

After successfully completing this activity, you should be able to:

1. Measure the diameter of the field of view of the microscope at different magnifications.

2. Convert the field diameter measurements from millimeters to microns by multiplying the millimeter measurement by 1,000.

3. Calculate the decrease in size of the field by knowing the increase in magnification.

(Activity 6)

USE OF THE MICROSCOPE TO MEASURE SMALL OBJECTS

Purpose: to learn how to evaluate the size of objects by comparing the size of the image with the diameter of the field; to compare the diameter of an object viewed under high-power with its diameter under low-power.

Materials:

Compound microscope.
Light source
Glass slide.
Medicine dropper.
Cover glass.
Section of half-tone shading from a newspaper.

Procedure:

A. Cut out a section of half-tone shading from a newspaper. Make a wet mount of this and examine it under low-power.

1. How many dots are there across the low-power field?

Observation: _____

2. How many dots are there across the high-power field?

Observation: _____

(If the answers to 1. and 2. above are not in the proper ratio for your microscope, check your work.)

3. What is the approximate diameter of each dot?

Observation: _____

4. How much distance is there between dots?

Observation: _____

B. Now, repeat the procedure in part A by measuring other materials:

MATERIAL	DIAMETER IN MICRONS	
	Low-power 100X	High-power 450X
Cotton thread		
String		
Human hair		
Onion cell		

CARING FOR YOUR MICROSCOPE

A. Is the lens clean?

B. Is the lens in place properly?

C. Is the mirror free from dust?

D. Have you learned to take care of your equipment?

Can you answer "yes" to all of these questions?

FEEDBACK

The resource person will rate your level of performance on various factors involved in the use of the microscope, using the "Student Performance Assessment Form" on page 21.

The level of your accomplishment is indicated by placing an "X" in the appropriate column under the "Level of Performance" heading. If, because of special circumstances, a performance component was impossible to execute or was not applicable, an "X" will be placed in the "N/A" column.

STUDENT PERFORMANCE ASSESSMENT FORM

Use of the Compound Microscope

	LEVEL OF PERFORMANCE		
	Satisfactory	Unsatisfactory	N/A
1. Listed the parts of the microscope with 90% accuracy.			
2. Stated the function of each part of the microscope with 90% accuracy.			
3. Carried the microscope from storage place to work area, using the technique given in the directions, with 100% accuracy.			
4. Cleaned the lens and mirror, using the correct technique, within 5 minutes.			
5. Adjusted the light entering the microscope, within 3 minutes.			
6. Placed a prepared slide on the stage.			
7. Using the coarse adjustment, focused the microscope in low-power with 100 % accuracy.			
8. Described the image seen under low-power with 100% accuracy.			
9. Changed the lens to high-power and, if needed, used the fine adjustment to focus, with 100% accuracy.			
10. Described the image seen under high-power with 100% accuracy.			
11. Compared the images seen under low-power and high-power with 100% accuracy.			